

# FUNDAMENTAL PROBLEMS IN COMPARATIVE PHONETICS AND PHONOLOGY: DOES UPSID HELP TO SOLVE THEM?

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## ABSTRACT

The approach to phonological comparison adopted in UPSID as well as other studies fails to recognize the abstract nature of even the most phonetically based definition of a phonemic system. Phonemes receive a simple phonetic translation based on one allophone. Phonological comparison is therefore carried out using no more than arbitrary selections of the phonetics of the languages involved. Phonemic systems belonging to the phonological level of comparison are being compared in phonetic terms, misrepresenting the abstract relational nature of a phonological system and at the same time grossly oversimplifying the complex phonetic patterns employed in languages to bring about differences in meaning.

While the appeal of many aspects of UPSID is recognized, the need for a more complex demarcation of three levels of phonetic and phonological comparison requiring different types and quantities of information is argued.

## 1. INTRODUCTION

Over recent years UPSID [9,10] (UCLA Phonological Segment Inventory Database) has become a popular tool in comparative phonetic and phonological research and teaching, e.g. [8,4]. It is undoubtedly appealing: the phonemic systems of a representative sample of 451 of the world's languages are accessible in machine-readable form. However, the contents of UPSID as well as the way in which the contents are regularly used to make comparative and typological statements have serious theoretical flaws.

This paper argues that the approach to phonological comparison adopted in UPSID, but also in the use of similar data collections such as the Stanford Phonology Archive [14 ,2], fails to recognize the abstract nature of even the most phonetically based definition of a phonemic system. It will be shown that this has far-reaching consequences for the majority of comparative and typological statements being made.

It will be argued that the comparison of linguistic sound systems must proceed on three levels:

**phonetic:** speech sounds are compared without any reference to their function.

**functional phonetic:** speech sounds are compared with reference to their structural distribution and their grammatical and lexical function.

**phonological:** comparison of relational systems set up on the basis of differences and similarities in the functional phonetic patterns.

Examples from well-known languages are used to illustrate

that while UPSID presents linguistic sound systems in a compact fashion, phonetic and functional phonetic comparison require far more detailed and complete descriptions of the phonetics, while a paradigm for phonological comparison would still appear to be lacking. It is argued that we still have no way of identifying sameness and difference in two phonological systems, a problem which is only apparently overcome by casting phonological contrasts in terms of a selection of features from a universal inventory.

## 2. THE MEANING AND SYMBOLIZATION OF PHONEMES

To understand why the phonemic systems that make up UPSID cannot be interpreted and compared as has been done in a number of places [9], or why other comparative studies [2,3] using similar material are behaving equally illegitimately, we must consider what a phonemic system can be, and more importantly what it cannot be.

The content of both the British [5] and American structuralist [1] phoneme are for the purposes of argument here essentially the same. The phoneme is seen as a family or group of sounds sharing some phonetic characteristic and being either in free variation or mutually exclusive in the contexts in which the individual members of the group occur. For certain purposes it is convenient to represent this group of sounds using a single symbol or symbol-diacritic complex. The choice of symbol may be dependent on the use to which it is being put. Jones [5] establishes a number of phonetic and distributional criteria to single out one allophone whose symbolization can be used to represent the phoneme, i.e. the family of sounds:

1. an articulatorily central allophone;
2. the most frequent allophone;
3. the allophone least affected by its context;
4. an allophone which can occur in isolation.

Except in the simple and rare case of the monophonemic phoneme - a family comprising a single allophone - the choice and consistent use of one of these criteria can lead to considerable differences in the set of symbols used to represent a phonemic system. In Standard High German, for instance, /x/ is most commonly used to represent the family [ç, x, χ], which fulfils the criterion of articulatory centrality if velar is seen to be between palatal and uvular, yet from the point of view of frequency of occurrence or contextual criteria, ç would be the more appropriate choice [6].

The Praguian phoneme [13] is a different object. It comprises just that set of phonetics - *phonological content* - which minimally distinguishes it from all other phonemes in an indi-

vidual system. In its most extreme form the phonological content may be only negatively defined, as is the case with German *r*, which Trubetzkoy defines as non-lateral, non-nasal and non-fricative [13, p. 60]. Rather appropriately, Trubetzkoy also talks of phonemic symbolization in negative terms:

One should not be misled by the use of the same international transcription symbols. These are merely a makeshift. Were one only to use the same symbolization for phonemes with the same phonological content one would require a separate alphabet for each language.

[13, p. 66, trans. AS]

Trubetzkoy illustrates this by comparing the very different phonological content of phonemes symbolized in a number of unrelated languages with *r*. The symbolization of a Praguian phoneme is governed by no more than ill-defined similarity between the phonological content of a phoneme and the phonetic translation of the symbol used.

It is clear, then, that in different phonemic schools the symbol chosen to represent a phoneme, regardless of the theoretical status of the phoneme itself, may be determined by any number of equally valid criteria, but in each case, it is no more than a shorthand device for talking about a complex abstract object and under no circumstances is it to be equated with a single sound in a general phonetic sense.

### 3. THE CONTENT AND COMPARISON OF UPSID PHONEMES

We can now examine the meaning and symbolization of UPSID phonemes. In UPSID each phoneme "is represented by its most characteristic allophone" [9, p. 6]. The allophone chosen to represent the phoneme is classified from a set of 58 phonetic attributes. Although we are given no description of the criteria used to establish the "characteristic" allophone, the UPSID phoneme evidently bears a strong resemblance to a Jonesian or American structuralist family or group of allophones. However, there is one crucial difference. The allophone no longer represents the phoneme, it *replaces* it; the phoneme and its characteristic allophone become one and the same thing. This reduces the phonemic system of a language to a small, arbitrary selection of its phonetics, i.e. just that set of allophones replacing the phonemes.

Reducing the phonological system of a language to a set of phonetic descriptions has attractive consequences. Any number of languages can be reduced in this fashion and comparison is simple, the establishment of statistical universals becomes a process of counting up the number of languages having items sharing the same phonetic characteristics. However, there are a number of reasons why it is illegitimate to reduce the phonetics of languages in this fashion and subsequently to compare these phonetic sets.

First, as we have seen, there are many ways of choosing appropriate phonemic symbolization, but no principled way of isolating an allophone to the exclusion of all others. So, for instance, there is no motivation for treating Spanish [β] (see Table 1) as any more characteristic than another allophone, such as the voiced bilabial plosive [b]. Likewise, in German voiced bilabial

plosion [b] is considered characteristic (Table 2), yet in parallel to [p<sup>h</sup>], [b] would be more appropriate as that allophone occurring initially in stressed syllables, or [β] as a frequently occurring intervocalic allophone. Any of these is characteristic in the sense that it is a phonetic complex bringing about lexical or grammatical contrast in utterance. It is little wonder then that both Maddieson and Crothers use the term "characteristic" without defining it.

	bilabial	labio-dental	dental	alveolar	palato-alveolar	palatal	velar	labial-velar
Spanish (011)								
voiceless plosive	p		t				k	
vl. sibilant affricate					tʃ			
vl. nonsibilant fricative		f	θ				x	
vd. nonsibilant fricative		β	ð				ɣ	
vl. sibilant fricative			s					
voiced nasal	m		ɲ			ɲ		
voiced trill				r				
voiced tap				D				
vd. lateral approximant			l			ʎ		
vd. central approximant						j		w

Vowels

high	i		u
mid	"e"	"o"	
low		a	

Table 1. The UPSID phonemic system for Spanish

	bilabial	labio-dental	dental/alveolar	alveolar	palato-alveolar	palatal	velar	uvular	variable place
German (004)									
vl. aspirated plosive	p <sup>h</sup>		"t <sup>h</sup> "				k <sup>h</sup>		
voiced plosive	b		"d"						
vl. sibilant affricate			"ts"						
vl. nonsibilant affricate	pf								
vl. nonsibilant fricative	f						x		h
vd. nonsibilant fricative	v								
vl. sibilant fricative				s	ʃ				
vd. sibilant fricative				z	ʒ				
voiced nasal	m		"n"				ŋ		
voiced trill								R	
vd. lateral approximant				l					
vd. central approximant						j			

Vowels

high	i, y:	long	u:	short	ɪ, ʏ	ʊ
higher mid	e:, ø:		o:			
mid					"ə"	
lower mid	ɛ:				ɛ, œ	ɔ
low		a:			ɐ	

Table 2. The UPSID phonemic system for German

The problem of singling out one allophone to the exclusion of all others in turn undermines the status of any comparative or typological statements made using them, particularly since many of these are statistical universals of the type “X% of the languages in the sample have Y”. To return to the examples just given, the frequency of occurrence of bilabial fricatives includes Spanish and not German, and a statement about voiced bilabial plosives excludes Spanish. Different, yet equally characteristic, phonemic representatives from both languages would reverse the inclusion of either language in such statements. If we project any number of such examples onto the vowel and consonant systems of the 451 languages in UPSID then the value of statistical universals based on such data becomes apparent.

UPSID is by no means alone in its approach. Comparative vowel system analyses by Crothers [2] using the Stanford Phonology Archive and Lass [7] are just two examples in which phonemic vowel systems are compared in terms of phonetically defined representatives. Indeed, Lass claims to be overcoming problems he sees in Sedlak’s [12] vowel system comparison by paying careful attention to phonetic detail. However, no amount of attention to detail addresses the central problem that a single allophone is the wrong object for comparison.

While phonetic detail may provide an accurate description of one allophone, it is more likely to obscure phonological relationships within a language. German again provides a good example of the problem. In the classification of the vowels in Table 2 /i:, y:, u:/ are at the same height (high) as /ɪ, ʏ, ʊ/, and /a:/ is at the same height (low) as /ɐ/, whereas /e:, ø:, o:/ are at different heights than /ɛ, œ, ɔ/. This description, while describing allophonic characteristics, is forced to neglect the linguistic relationships, failing to show that /ɛ, œ, ɔ/ stand in the same relationship to /e:, ø:, o:/ as /ɪ, ʏ, ʊ, ɐ/ do to /i:, y:, u:, a:/. Paying greater attention to phonetic detail offers no help, since at most this would “lower” the short set /ɪ, ʏ, ʊ/ to the same height as /e:, ø:, o:/. The situation is complicated still further by many southern varieties of German which have the same phonological relationship between long and short vowels as that of the standard variety shown in Table 2. However, the phonetic difference between long and short vowels is only marginally qualitative, forcing the short vowels into similar descriptive slots as their long congeners, i.e. /i, y, u/ vs. /i:, y:, u:/, /ɛ, ø, ɔ/ vs. /e:, ø:, o:/. While going some way to capturing qualitative allophonic differences between different varieties, similarities in the relationships between the long and short vowel groups in different varieties of the *same* language are successfully obscured.

The last problem we will address in the UPSID approach is the haphazard and unprincipled way phonetically defined phonemic systems are compared. This becomes most apparent in the chapter on liquids and in particular in the discussion of “r-sounds”. While it may be possible to categorize sound types in terms of descriptive phonetic labels, e.g. plosive, voiced, the link between the “r-sounds” has its origins in the wide range of phonetic possibilities associated with a phonological object often symbolized with /r/ in many Indo-European languages. This is unjustifiably projected onto a phonetically disparate set of patterns in other unrelated languages which happen to be symbol-

ized with r/R-based symbols (r, r̥, R, ʀ, ʁ). Ironically, Maddieson has to establish criteria for delimiting r-sounds from other phonetic categorizations, such as fricatives, meaning that different varieties of a language such as German would arbitrarily be considered to be r-less depending on the characteristic allophone chosen to represent r (in the Praguian sense). Following Maddieson’s own criteria, a variety with /ʁ/ (incidentally probably a better choice for the UPSID inventory) would not have an r-sound because [ʁ] is a uvular fricative, whereas one with /R/ would.

#### 4. LEVELS OF PHONETIC AND PHONOLOGICAL COMPARISON

Phonetically defined phonemic systems mix levels, preventing either serious phonetic or phonological comparison. What is required is the clear separation of levels into phonetic, functional phonetic and phonological, described at the outset of this paper. Each level requires different quantities and types of information about sound systems.

##### 4.1 Phonetic

Comparative phonetics can proceed without any recourse to the linguistic function. So, for instance, the investigation of the relationship between fundamental frequency and vowel height can proceed by merely identifying vocalic portions which meet particular phonetic criteria however defined (open, close, high F1, low F1 etc.). This is also the level at which to identify sound types used in different languages. Again there is no question of linguistic function - a nasalized vocalic portion in English is equivalent to a similar object in French or Portuguese; a voiceless bilabial plosive occurring as the result of epenthesis has the same status as any other plosive in the language.

##### 4.2 Functional phonetic

Functional phonetic comparison must examine the phonetic correlates of phonological elements *in toto*. In phonemic terms functional phonetic comparison must embrace all the allophones of a phoneme together with information about the contexts in which they occur. So, for instance, in many varieties of English we find [t<sup>h</sup>], [t], [ɾ] and [ʔ] as allophones of a single phoneme. These variants together with their contexts can be compared with the phonetically similar allophonic groups and contexts in other languages. Such comparison reveals any parallels and differences in the phonetic correlates in various contexts. The Stanford Phonology Archive was designed to contain allophonic information, yet inconsistencies mean that large scale comparative analyses only employ the data in phonetically interpreted phonemic terms, e.g. [2].

It is at this level that UPSID is working, if only in an arbitrarily selective fashion, i.e. some of the functional phonetics from one language are being compared with some of the functional phonetics from another.

##### 4.3 Phonological

Finally, we turn to phonological comparison. At this level cross-linguistic comparison may only be possible in very restricted terms and will often be carried out in combination with functional phonetic analysis. So, for instance, one method of

establishing the relative complexity of the vowel systems in two phonemic systems is simply to count the number of elements in each. Examining and comparing the allophonic groups behind these systems will reveal any differences in the way in which the vowel space is exploited in each language.

Up until now nothing has been said about universal feature theory, but this approach does not offer any firmer ground for phonological comparison, despite claims to the contrary [11]. Casting the phonological contrasts in a language in terms of universal feature specifications does not solve the problem any more than UPSID's system of phonetic classification. As there are no criteria for assigning the same feature to different phonetic patterns in two languages or even to assigning them to different sets of phonetics in the same language, the inventory of features becomes little more than a list of possible contrasts which must simply be large enough to capture the number of contrasts in a particular language. Stating that two languages have the feature [ATR] or [labial] is as trivial as stating that phonemes in two languages are symbolized with **k** or **r**.

The sort of question that we may never be able to answer, other than in the trivial sense described above, is whether broadly similar phenomena across languages are just different manifestations of the same thing. Do, for instance, the phonemic alternations (as symbolized in UPSID) /p/~p:/ in Finnish, /β/~p/ in Spanish, /p/~p<sup>h</sup>/ in Mandarin or /b/~f/ in Vietnamese constitute exponents of the same universal contrast?

## 5. CONCLUSION

This paper has demonstrated that the comparative and typological statements made using the phonetic interpretation of phonemic systems as is done in UPSID, but also in comparative analyses using similar data collections such as the Stanford Phonology Archive are flawed. The compactness and the ease with which such systems can be compared is appealing, yet the unprincipled reduction of the complexity of linguistic sound systems severely weakens any qualitative or quantitative statements made using them. Instead, a clear demarcation of levels is required. Each level demands differing types of quantities of information.

UPSID itself will no doubt continue to be used as a vademecum for phonetic and phonological comparison, and it certainly has applications as a reference for identifying languages with a particular sound type, or for establishing the degree of phonological complexity in terms of phoneme count; however, for serious qualitative or quantitative phonetic and phonological comparison UPSID is of little use. Contrary to Maddieson's claim that those who consider phonology in terms of purely abstract constructs are not interested in investigating language universal properties [9, p. 160], we can equally argue that the phonetic interpretation of phonemic inventories may make them comparable, but tells us little about the languages they claim to be representing.

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